

NON-PUBLIC?: N
ACCESSION #: 9109270191
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Waterford Steam Electric Station Unit 3 PAGE: 1 OF 10

DOCKET NUMBER: 05000382

TITLE: Inadvertent Multiple Engineered Safety Feature Actuation due to
Test Circuit Malfunction
EVENT DATE: 08/25/91 LER #: 91-019-00 REPORT DATE: 09/24/91

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: J. G. Hoffpauir, Maintenance TELEPHONE: (504) 464-3138
Superintendent

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: JC COMPONENT: CNTR MANUFACTURER: C770
REPORTABLE NPRDS: N

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On August 25, 1991, at 0214 hours while performing OP-903-107, Plant Protection System Functional Test, the plant received a Safety Injection Actuation Signal (SIAS), Containment Isolation Actuation Signal (CIAS), and Main Steam Isolation Signal (MSIS). Subsequently, a Reactor Trip occurred on loss of power to the Control Element Drive Mechanism motor generator sets due to the SIAS. Operations Control Room personnel entered the Emergency Operating Procedures and carried out the immediate operator actions. Recovery was performed in accordance with OP-902-006, Loss of Main Feedwater Procedure. The root cause of the event was an unforeseen design problem. When the Matrix Relay Hold pushbutton (Cutler-Hammer Model #10250T506) was pushed, the speed of insertion was rapid enough such that the energization of the test coils occurred before the energization of the hold coils, resulting in an actuation of the SIAS, CIAS, and MSIS functions under test. A modification is being

considered by System Engineering to replace the pushbutton with a three 3) position spring return handswitch.

END OF ABSTRACT

TEXT PAGE 2 OF 10

Reportable Occurrence:

On August 25, 1991, at 0214 hours, while performing OP-902-107, Plant Protection System Functional Test, on the channel AC matrix module (EIIS Identifier - IMOD) an actuation of the Safety Injection Actuation Signal (SIAS), Containment Isolation Actuation Signal (CIAS), and Main Steam Isolation Signal (MSIS) occurred. A Reactor Trip occurred when the SIAS opened the power supply breakers (EIIS Identifier - EC/BKR) for the Control Element Drive Mechanism (CEDM) Motor Generator Sets (EIIS Identifier - AA/MG). Four hour notification via the Emergency Notification System (ENS) was made to the NRC in accordance with 10CFR50.72(b)(2)(ii) due to unplanned ESF and Reactor Protection System (RPS) (EIIS Identifier - JC) actuations. This event is reportable under 10CFR50.73(a)(2)(iv) as an unplanned ESF (including RPS) actuation.

TEXT PAGE 3 OF 10

Initial Conditions:

Plant Power: 100%

Mode: 1

Procedure being performed.

OP-903-107, Plant Protection System Functional Test, Section 7.24, Matrix Test, Module AC.

Technical Specification LCOs in Effect:

3.3.1 - Steam Generator #2 Low Pressure Channel "C" setpoint out of tolerance

Major Equipment Out of Service:

Auxiliary Feedwater Pump (EIIS Identifier - SJ/P) due to a leak on the seal water cooling line

MS-320B, Steam Bypass to Condenser B2 (EIIS Identifier - SB/V) due

to a weld crack on the steam bypass line at the Main Condenser (EIIS identifier - SG) penetration

TEXT PAGE 4 OF 10

Event Sequence:

The Waterford 3 Plant Protection System (PPS), provided by Combustion Engineering, consists of four independent channels to provide automatic Reactor Protection Shutdown (EIIS Identifier - JC) and Engineered Safety Features Actuation (ESFAS) (EIIS Identifier - JE) when required. In accordance with Technical Specifications, a functional test of each PPS channel is performed once per month. Part of this functional test is the Logic Matrix Test. The Logic Matrix Test verifies proper operation of the six, two out of four coincidence, logic matrices. The matrix relay hold pushbutton (Cutler-Hammer Model #10250T506) performs three functions: 1) Interr

pts test power to the matrix test modules not being tested 2) Applies test power to the matrix relay bistable coils (EIIS Identifier - RLY/CL) through the use of early closure contacts (EIIS Identifier CNTR) on the pushbutton, and 3) Applies test power to the matrix bistable relay opposing coil. During the circuit test sequence, the relay hold pushbutton is depressed and through use of the early closure contacts, test power is applied to the aiding coils of the matrix trip path relays before the bistable relays are energized.

The operator completed matrix relay testing of the SIAS/CIAS/MSIS for positions 1, 2, and 3 on the matrix relay trip select switch. As indicated by a Sequence of Events (EIIS Identifier - IQ) printout, all relays were reset before the next test. The operator selected the #4 position on the matrix relay trip select switch and pushed the matrix relay hold pushbutton. When the pushbutton was pushed at 0214 hours, the operator heard the sound of annunciators in the Control Room and thought he saw the matrix relay lights extinguish. He quickly released the pushbutton.

TEXT PAGE 5 OF 10

The Secondary Nuclear Plant Operator (SNPO) saw the annunciator actuations and indications of a Reactor Power Cutback (RPC) with CEA groups 5 and 6 inserted. The SNPO placed the CEA Mode Selector Switch (EIIS Identifier - AA/SEL) in "Auto" in accordance with OP-901-003, "Reactor Power Cutback". The Reactor Power Cutback actuated due to the rate of rise of Pressurizer (EIIS Identifier - AB/PZR) pressure and drop in Main Steam (EIIS Identifier - SB) flow resulting from the closure of the Main Steam Isolation Valves (MSIV) (EIIS Identifier - SB/ISV). At

0214 hours a reactor trip occurred due to the SIAS actuation causing the power supply breakers for the CEDM Motor Generator Sets A and B to open.

During this event the Reactor Coolant System (RCS) (EIIS Identifier AB) pressure did not exceed 2290 psia and the pressurizer safety relief valves (EIIS Identifier - AB/RV) did not lift. Minimum RCS pressure reached was 1950 psia, which is above the automatic SIAS setpoint of 1684 psia. No safety injection flow was initiated into the RCS. Steam Generator (SG) (EIIS Identifier - AB/SG) #1 and #2 pressure increased to 1110 psia and 1112 psia respectively. Main Steam Safety Valves (MSSV) (EIIS Identifier - SB/RV) lifted and the Atmospheric Dump Valves (ADV) (EIIS Identifier - SB/PCV) on both Steam Generators opened due to the pressure increase. After entry into OP-902-006, Loss of Main Feedwater, operators lowered the ADV setpoint on both ADV controllers (EIIS Identifier - SB/PCO) to 950 psia. This action was taken as a proactive measure to seat the MSSV's. The MSSV's functioned as designed. Steam generator pressure and RCS temperature were then controlled by the ADV's. Recovery was performed in accordance with the Emergency Operating Procedure OP-902-006.

TEXT PAGE 6 OF 10

Sequence of Events:

0214 # ESFAS Actuation (SIAS, CIAS, MSIS)

Reactor Power Cutback (RPC)

Main Steam Safety Valves Open

Reactor Trip Actuated

Emergency Feedwater Actuation Signal (EFAS) #1 and #2 due to low level in Steam Generators 1 and 2

0224 * Enter OP-902-000, Emergency Entry Procedure

0239 * Verified SIAS/CIAS termination criteria

0240 * Secured Charging Pump "AB" (EIIS Identifier - CB/P)

0242 * Secured Charging Pump "A" (EIIS Identifier - CB/P)

0243 * Secured EFW pump "AB" (EIIS Identifier - BA/P)

0245 * Secured Low Pressure Safety Injection Pump (EIIS Identifier - BP/P) "A"

* Enter Technical Specification LCO 3.7.1.3 due to Condensate Storage Pool (EIIS Identifier KA/TK) level dropping below 82%

0246 * Secured High Pressure Safety Injection (HPSI) (EIIS Identifier - BQ/P) Pump "A"

0248 * Reset SIAS and CIAS

0252 * Chemical Volume and Control System (CVC) Letdown (EIIS Identifier - CB) returned to service

0259 * MSIS Reset

0301 * Verified all SIAS and CIAS actuations (OP-902-006 Attachment 1 & 2)
0356 * Opened Main Steam Isolation Valve (MSIV) #1 (EIIS Identifier - SB/V)
0411 * Opened Main Steam Isolation Valve (MSIV) #2 (EIIS Identifier - SB/V)
0423 * Started Main Feedwater Pump #2 (EIIS Identifier - SJ/P)
0430 * Opened Main Feedwater Isolation Valves (EIIS Identifier - SJ/ISV)
0432 * Feeding both SGs with Main Feedwater (EIIS Identifier - SJ)
0525 * Reset EFAS-1 and EFAS-2, Secured EFW Pumps "A" and "B"
0613 * Exit OP-902-006, "Loss of Main Feedwater" (exit criteria met)
* Entered OP-10-001, "General Plant Operations"

- Automatic Action * - Manual Action

TEXT PAGE 7 OF 10

Troubleshooting commenced under Condition Identification (GI) 277255 and Work Authorization (WA) 01082946. Immediate corrective actions consisted of: 1) Replacing the Matrix relay hold pushbutton, 2) load testing the Matrix power supply, 3) changing the Matrix relay cards for trip path "4", 4) replacing the transistor driver board for the Matrix Relay Test coils, and 5) checking for grounds in the Matrix circuitry. Follow-up actions included: 1) load testing the transistor card for 3 weeks, no problems were found, 2) x-raying the matrix relay hold pushbutton, no problems were found, 3) testing each relay, no problems were found, and 4) constructing a test circuit mock-up using an actual pushbutton and relay.

In the circuit test mockup, the Instrumentation and Controls department determined that the speed with which the matrix hold pushbutton was pushed can cause dramatic changes in the holding coil/ test coil energization sequence. The time between the coil energization sequence can become insignificant relative to the longer rise time of the extremely inductive circuitry. If the hold pushbutton is not slowly depressed, so that the time between the start of the hold coil energization and the start of the test coil energization is at least 100 milliseconds, sufficient time is allowed for the hold coil to energize before the test coil. Should the speed of the hold pushbutton increase such that the time between the start of the hold coil energization and the start of the test coil energization is only 10 milliseconds, a race occurs between the hold coil and the test coil to energize. If the test coil energizes before the hold coil, an actuation will occur.

TEXT PAGE 8 OF 10

ROOT CAUSE:

Design Problem: The design of the Matrix testing circuit allows a trip to occur when the Matrix relay hold pushbutton is depressed too fast. This causes the bistable relay contacts to interrupt power to the four Matrix relay primary coils before the test circuit voltage is fully applied to the Matrix relay holding coil.

CORRECTIVE ACTIONS:

- 1) (Interim Action): A letter was sent from the Instrumentation and Control department to the Operations department on August 30, 1991. This letter informed operations of the results of the investigation of the PPS and the problems found with rapid pushbutton operation. Operations personnel were informed on August 30, 1991, of the problems with the pushbutton by Operations Daily Instructions. Caution Tag #91-046 is in place on each matrix module adjacent to each matrix relay hold pushbutton. This caution tag warns the operator of the problem with rapid pushbutton operation.
- 2) A modification is being considered by System Engineering to replace the pushbutton with a three (3) position spring return handswitch.

TEXT PAGE 9 OF 10

SAFETY SIGNIFICANCE:

Because of the reactor power cutback, which occurred due to the MSIS signal, the RCS pressure transient was significantly less severe than for a Loss of Condenser Vacuum or a Loss of Main Feedwater event. As a result of the inadvertent SIAS, CEA's had already begun to drop into the core prior to the occurrence of a Reactor Trip signal. The consequences of this event are bounded by the accidents previously analyzed in FSAR sections 15.1.1.4 (Inadvertent ADV opening), 15.2.1.3 (Loss of Condenser Vacuum), and 15.2.2.5 (Loss of Main Feedwater), Inadvertent ADV Opening is a Moderate Frequency incident, and Loss of Condenser Vacuum and Loss of Main Feedwater are classified as Infrequent incidents. Therefore, the health and safety of the general public and plant personnel was not jeopardized during this event.

Equipment Problems:

The Matrix Relay Testing Circuit did not prevent an actuation during the

PPS Functional test. Reference the Root Cause and Corrective Action sections in this report.

TEXT PAGE 10 OF 10

PREVIOUS EVENTS:

Industry Events:

02/19/88: At San Onofre 3, while performing a plant protection system functional test, an SIAS occurred when the matrix relay hold pushbutton was depressed. Pushbutton was model 10250T506 (Cutler-Hammer)

02/18/89: At San Onofre 2, while performing a PPS functional test, a spurious EFAS actuation occurred. Root Cause determined that the pushbutton internals had been installed incorrectly during the manufacturing process. Pushbutton was model 10250T (Cutler-Hammer)

06/29/89 At San Onofre 3 a Recirculation Actuation Signal occurred when the matrix relay hold pushbutton was depressed and no trip path was selected. Pushbutton was model 10250T506 (Cutler-Hammer)

Waterford 3 Events:

LER-90-004:

An inadvertent Emergency Feedwater Actuation (EFAS) occurred during Plant Protection System matrix relay testing. The root cause of this event was a test circuit malfunction due to the incorrect assembly of the early closing contact block assembly of the matrix relay hold pushbutton.

LER-85-006:

An inadvertent Containment Spray Actuation (CSAS) occurred during PPS functional testing due to personnel error. The operator did not reset the CSAS actuation relays when required during testing.

ATTACHMENT 1 TO 9109270191 PAGE 1 OF 1

Entergy Entergy Operations, Inc.
Operations P.O. Box B
Killona, LA 70066

Tel 504-739-6650

Ref: 10CFR50.73(a)(2)(iv)

W3B5-91-0267

A4.05

QA

September 24, 1991

U.S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, D.C. 20555

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Submittal of Licensee Event Report

Gentlemen:

Attached is Licensee Event Report Number LER-91-019-00 for Waterford Steam Electric Station Unit 3. This Licensee Event Report is submitted pursuant to 10CFR50.73 (a)(2)(iv).

Very truly yours,

D. F. Packer
General Manager - Plant Operations

DFP/JDC
Attachment

cc: Messrs. R. D. Martin
G. L. Florreich
J. T. Wheelock - INPO Records Center
E. L. Blake
N. S. Reynolds
NRC Resident Inspectors Office

*** END OF DOCUMENT ***
